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Avifaunal Diversity of Wyra and Paler Reservoirs of Khammam District, Telangana, India

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ABSTRACT

Birds are important species for conservation planning and environmental assessments in view of achieving better ecological understanding and its balance. Measuring the Biodiversity has a significant role in indicating the ecological balance of the nature. Therefore objective of this paper is to conduct the research study on Biodiversity of Avifauna in Terrestrial and Aquatic surroundings

of Wyra, Paler reservoirs of Khammam district of Telangana state, India. The results are confirmed that the occurrence of 40 species of Birds belonging to 35 genera, 24 families and 13 orders during January to December 2010. Results confirm that the structure of a bird community is a good indicator of biodiversity, particularly useful where biodiversity is high. A cooperative program is needed to promote new surveys and publish their results, as a contribution for measuring and monitoring biodiversity, especially in complex endangered habitats.

Keywords: Avifaunal diversity, Aquatic ecosystem, Bio-Diversity Index, Bird Diversity

Abbreviations: ANOVA - one way analysis of variance

1. INTRODUCTION

Bird species are playing important role in the Natural Ecosystem. Ecology can be characterized by the relationship between living things and environment in a scientific manner. In a large the ecology in the environment is that consists of all of the flora as well as fauna living within a zone and the interactions between them. The term environment refers to all external conditions and factors that affect living organisms (Islam & Samsudin, 2014). There are about 10000 bird species in the world. Although bird species have an important mission to continue for ecological balance, but for the last three centuries, industrial developments and anthropological effects have degraded habitats and caused the natural balance to deteriorate. Approximately 200 bird species had been affected directly or indirectly from these negative changes. 1012 species are being threatened by threats that habitat loss, human prosecution and introduced predators. For example, habitat loss was cited as an important source of risk for over 70 percent of threatened species, along with human persecution and/or introduced predators were cited in 35% of case (Tabur & Ayvaz, 2010).

Birds are among the best monitors of the environmental changes and have been used to evaluate the environment throughout the history as 'biomonitors' and; the changes in their population, behavior patterns and reproductive ability have been used to examine the long term affects of habitat fragmentation. Hence they are the good indicators of ecological status of any given ecosystem (Bilgrami 1995; Harisha & Hosetti, 2009). Birds are very visible and integral part of the ecosystem occupies many trophic levels in a food chain ranging from consumers to predators. Their occurrences have been helpful as environmental health indicator, plant pollinators and seed disposal as well as pest controller (Hadley, Hadley & Betts, 2012).

Given the significance of birds for conservation planning and environmental assessments, there is a need for a better ecological understanding of the role of avian community structure in conservation decision-making (Tabur & Ayvaz, 2010). Birds are ideal bio-indicators and useful models for studying a variety of environmental problems as they are very sensitive to the slightest of environmental changes and are important health indicators of the ecological conditions and productivity of an ecosystem (Newton 1995; Desai & Shanbhag 2007; Li & Mundkur 2007). India has a rich avian diversity as it provides for a wide variety of wetland habitats that act as ideal wintering grounds for migratory water birds. According to Islam & Rahmani (2005) the state of Andhra Pradesh is a home to as many as 16 sites of identified important bird areas of avifaunal significance.

Study of avifaunal diversity is an essential ecological tool and can act as an indicator to evaluate different habitats both quantitatively and qualitatively (Bilgrami, 1995). Recently the study on avifaunal diversity has been decreasing due to anthropogenic activities and destruction of natural habits by human beings and also natural disasters. Many species of birds may be forced to inhabit in the urban areas and constrain to breed there (Harney, 2014; Ramesh, Nijagunappa & Manjunath, 2014). Birds are important animal group of an ecosystem and maintain a tropic level. Therefore, there is a need of detail study on avifauna and their ecology is important to protect them. Birds play essential and diverse roles in religion and culture. They have their functional role in the ecosystem as potential pollinators and scavengers and are rightly called as bio-indicators of the nature (Bhadja &Vaghela 2013).

Avifaunal diversity will give the benefit to know the climatic conditions of particular region and availability of natural resources and indicates the sustainability through Bio existence. Which will helps to know the availability of Rare, Vulnerable, and Endangered and Extinct Bird species in the particular region.

The main objective of the study is to identify and measure the Biodiversity of Avifauna in Terrestrial and Aquatic Surroundings of Wyra reservoir (17.2O N, 80.375O E) (See Figure 6), Paler reservoirs (17.2O N, 79.95O E) (See Figure 7) of Khammam district of Telangana state, India and further to provide a conclusion on their corresponding order and family to which they belong to.

The scope of the study is limited to only the bird diversity related to semi-arid region habitats of Wyra and Paler reservoirs of Telangana state.

2. MATERIALS AND METHODS

The detail of the literature survey conducted has been presented in a tabular form (See table 1).

Table 1 Avifauna Diversity of Hot arid- Semi arid regions of India

Sl.No.	Avifauana Diversity - Aspect	Lake /Reservoir (s)- Location	Authors & Year
1.	Avifauana Species Diversity and Abundance	Tilyar Lake, Rohtak, India	Singh & Laura (2013)
2.	Faunastic Studies and Limmnological Studies	Wyra Lake, Khammam, India	Srinivasulu (2013)
3.	Study on Avifaunal diversity from two fresh water sites i.e. Lake and Reservoir	Lalapari lake, Aji reservoir, Rajkot, Gujarat	Bhadja & Vaghela (2013)
4.	Avifaunal Diversity of Tawa Reservoir and its surrounding areas	Tawa Reservoir , Hoshangabad District, Madhya pradesh	Joshi & Shrivatava(2012)
5.	Floral and Avifaunal Diversity	Thol lake, Wildlife (Bird) Sanctuary, Gujarat	Karia (2012)
6.	ENVIS News letter on Wetland ecosystems and inland wetlands	Nalsarovar Bird Sanctuary, Gujrath	SACON ENVIS (2012)
8.	Birds of Osmanabad District	Terna Lake, Maharashtra	Narwade &Fartade (2011)
9.	Avifaunal diversity of Tiruverumbur	Tiruchirapalli, Tamilnadu	Balasundaram & Rathi (2004)
10.	Influence of Narmada Water Inundation on the Duck Populations	Wadhwana Irrigation Reservoir	Padate, Deshkar & Sapna (2007)

The term habitat is usually defined as a dominant vegetation formation and the definition and meaning of habitat heterogeneity varies considerably (Tews et. al, 2004).

Editor-Director (2013) has published a research report on its studies over faunistic and Limonological studies conducted on Wyra reservoir on the theme of wet land ecosystem. Similar research studies conducted previously at Wyra Lake is: Sriniviasulu (2013), who has conducted similar research of what author have done during the year 2010 i.e. avifaunal diversity using the aquatic and terrestrial habitats at Wyra reservoir. The report of Srinivasulu (2013) can be found at Editor-Director (2013) in passing. While authors (John Mohammad & Krishna, 2015) focused on measuring the biodiversity of avifauna at Wyra Reservoir, Srinivasulu & Nagulu (2002), Srinivasulu (2004), Srinivasulu (2006) & Srinivasulu (2013) just focused on the identification part of avifauna diversity.

Habitat loss is the major factor affecting the population of migratory and resident birds directly or indirectly (Prasad Prasad, Ramakrishna, Srinivasulu, & Srinivasulu 2014). Pesticides can affect farmland birds in a number of different ways and use of pesticides within different farming systems have led to a decline in farmland bird populations (Burn, 2000). Availability of food in different seasons, different types of vegetation, agricultural lands, and accessibility of water in the area, field activities and good weather conditions were observed for favorable conditions for birds to survive in this area. Birds are a good medium for dispersing seeds, pollinating plants, biological control and they are important to continue the ecological cycle. Long term assessment of bird species richness will help in understanding the impact of changing environment on birds and also support in creating a scientific database for proper management of the ecosystem to ensure better conservation, both of the habitats and the avian diversity (Prasad. et al., 2014).

Birds are important group of aquatic ecosystem; they feed on insects, small fishes and other animals of the reservoir Donar, Reddy, & Deshpande, (2012). The bird classification taxonomy usually could start at the level DNA; however it could be better

represented at least at the level of order, family and species. On the Sibley-Monroe classification, the world's living birds are grouped into 23 orders, comprising 146 families and more than 9,700 species (Newton, 2003). As of today there are approximately over 9,000 bird species and more than 1300 bird species are in India, with almost 150 having become extinct after the arrival of Humans. Birdlife International, 2010 recorded that the IUCN Red List of endangered birds has already recognized 1,226 bird species as threatened globally and India with 88 threatened bird species is ranked at seventh position (Arya & Mishra, 2014). Hughes, Daily, & Ehrlich (1997) reported that in tropical forests on an average 1,800 populations are being destroyed per hour while 16 million annually. Gaston and Black Burn (2003) estimated that science pre agricultural levels over all global bird populations declined by fifth to a quarter due to change in land use pattern alone.

2.1. Theoretical Framework

Theoretical frame work representing the relationship between the Biodiversity index of availability of Avifaunal diversity and its sustainability of Avifauna Diversity (Figure 1).

Species diversity is a measure of diversity that incorporates both the number of species and assemblage and some measure of the relative abundances (Gotelli & Chao, 2013). A direct link occurs between biological diversity, ecosystem function, and sustainability of natural and managed ecosystems (Singh & Laura, 2013). While Species diversity is a property at the population level, the functional diversity concept is more strongly related to ecosystem stability (Mohammad & Krishna, 2014).

Lakes are highly complex and fertile ecosystems in the world, constituting a treasury of biodiversity (Birasal, 2010). Biological diversity or Biodiversity means the variability among living organisms that derives from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part. This includes diversity within species (at a genetic level), between species and of ecosystems (EASAC, 2005). To use biodiversity in a sustainable manner means to use natural resources at a rate that the Earth can renew them. It's a way to ensure that we meet the needs of both present and future generations (UNEP-CBD, 2010). Bird monitoring data provides the basis for biodiversity policy related indicators. Such indicators focus on informing conservation policy and aim to reduce complex biological information to simple and easily understandable messages of political concern (Droschmeister & Sukopp, 2009). Such monitoring also helps to maintain or restore ecological integrity (Carignan & Villard, 2002).

Birds are one of the common fauna of all habitat types because their diversity and abundance can reflect ecological trends in other diversity (Kangah-Kesse, Attuquayefio, Owusu & Gbogbo, 2007). Birds cannot tolerate even slight ecological disturbance because of their highly specific habitat requirements. Bird species play a significant role in many food webs of aquatic system nutrient cycles. But the increase of human disturbances towards these ecosystems causes threats to bird diversity. An assessment of abundance and diversity of bird species in any ecosystem serve as a good indication of the health of the environment in and around the ecosystem (Singh & Laura, 2013).

2.2. Research Methodology

CRASP methodology (Vasista & AlSudairi, 2016) as an evaluating research methodology has been adopted with which it has been concluded to work on developing the process of working towards establishing the benchmarking for the data to be observed. CRASP methodology talks about the significance of verifying and validating the observed data against referencing data. Such referencing data has to be considered as benchmarking data.

The format of research content representation usually follows what is called Gen-Spec Research methodology (Vasista, 2011).

In the widespread interest of measuring the biodiversity (e.g. bird diversity and abundance) of avifaunal attitudes towards their abundance and status there is a need to establish a benchmarking. Such kind of benchmarking helps researcher in providing better conclusions towards the bio diversity status and abundance as well as providing conclusions on their belongingness to the family, order and genus (Ambrose & Riemersma, Undated).

The semi-arid region is a region with a rainfall varying from 400 to 1000mm and dominated by grass and shrub species. The semi-arid region shows high avian numbers especially granivorous species such as finches, Munias, larks, doves and pigeons. More than 100 species of birds use the semi-arid grass lands for foraging and/or nesting. About 17 species are exclusively present in this zone. Four species are found only in the semi-arid and Deccan regions and nowhere else. These four species are: The Malabar crested lark Galerida malabarica, the Syke's crested lark G. Deva, the Green Munia Amandava Formosa and the Rock Bush Quail Perdicula Argoondah (IBCN, 2015, p. 15). Corresponding order and family of these four species are given below (see Table 2).

Table 2 Order and Family of Specific Species found in Semi-Arid and Deccan Regions (but nowhere else)

Sl. No.	Name of the Species- Scientific Name	Order	Family	Reference
1.	The Malabar Crested Lark - Galerida Malabarica	Passeriformes	Alaudidae	Dasgupta, Sipra Basu Roy & Dutta, (2002)
2.	Syke's Crested Lark - G. Deva	Passeriformes	Alaudidae	Dasgupta, Sipra Basu Roy & Dutta, (2002)
3.	Green Munia - Amandava Formisa	Passeriformes	Passeridae	Mogliresorts, (2015)
4.	Rock Bush Quail - Perdicula Argoondah	Galliformes	Phasianidae	Dasgupta, Sipra Basu Roy & Dutta,(2002)

The Wyra, Paler reservoirs are located in Khammam district, Telangana, India. Wyra reservoir lies between North latitude 17° 11 and East longitude 80° 22 ́covering the total catchment area of 19.14 sq.km and Paler reservoir lies between North latitude 17° 12 and East longitude 79° 54 ́. The climatic conditions of the study area can be categorized as hot summer, cool winter and rainy season. The region gets maximum rainfall from south west monsoon. These particular regions get maximum of its rain fall from June to September. During the study period i.e. January 2010 to December 2010. Highest rainfall was observed in the month of June. The reservoirs water is generally used for drinking, agriculture, boating (recreation), electricity (hydropower) generation and fish culture. The water body provides considerable ecological diversity to support a large population of wetland birds (Islam & Rahmani 2005).

The study area for the avifauna diversity has been considered to be studied has been set as Avifauna diversity in hot arid and hot semi-arid regions in general and Wyra and Paler reservoir of Khammam District in Telangana state in particular.

Regular seasonal surveys were conducted during January 2010 – December 2010 with a frequency of once in every month randomly made visits to the site. Notes were taken on different avifauna species and habitat they occupied. Surveys are conducted by walking in a random route pattern in the open spaces and nearby reservoir areas. Birds were observed continuously through a fast-paced walk while taking a note of species, frequencies of sighting, general bird movement and behavior across the route was recorded in datasheet (Vallejo Jr., B.M., Aloy, A.B. & Ong, P.S., 2008).

The status of species was established upon the following criteria: Resident, Winter Migrant and Summer Migrant as well as abundance of species were graded as Abundant, Common, Occasional and Rare (Mehra, Sharma and Mathur, 2005); (Ali & Ripley, 1983); (Ali, 1996); (Grimmet, Inskipp & Inskipp, 1999).

2.3 Biodiversity Index

Species are by definition different from each other (Cousins, 1991). To analyze bird community diversity, we used Shannon (H') and Simpson's (D) (Simpson, 1949) diversity indices. Shannon-Wiener Index was generally used in ecological studies concerned with the number and abundance of rare species while Simpson's index is for more abundant or common bird species diversity (Vallejo Jr., Aloy & Ong, 2009). Shannon-Weaver index assumes the individuals are randomly sampled from an independent large population

and all the species are represented in the sample. Shannon diversity is very widely used index for comparing diversity between various habitats (Clarke & Warwick, 2001, Bibi & Ali 2013).

Shannon–Weaver's species diversity index was proposed by Shannon–Weaver (1949) as a measure of information and their diversity across the different areas. Shannon–Weaver's (H) is commonly used to cauterize species diversity in a community. The index account for both abundance and evenness of the species presents. The proportion of the species (pi) is calculated and multiplied by the natural logarithm of this proportion (log Pi).

As per the formula given by Shannon-Weaver (1949):

$H = - \sum (ni/N) \text{ Log } (ni/N)$ or $H = - \sum Pi/\text{Log } (Pi)$

Where,

H = Shannon–Weaver's index of species diversity individuals.

ni = Total number of individuals.

N = Total number of individuals of all species.

Pi = Importance of probability for each species = ni/N

3. RESULTS & DISCUSSION

The present study deals with documenting the diversity of birds using the aquatic and terrestrial habitats at Wyra, Paler reservoirs of Khammam District, Telangana State. The results confirmed that the occurrences of 40 species of birds are belonging to 35 genera, 24 families and 13 orders. Availability list of Avifauna Resources in Wyra and Paler Reservoirs was given in Table-5.

In both reservoirs, the belongingness-wise status of birds is: 82% are residents, 13% are winter migrants and 5% are summer migrants (see Fig 2). Further, the abundance-wise they are: 7% are abundant; 85% are common; 5% are having rare scientific name with † symbol and 3% are occasional as shown in Fig. 3. The Avifauna abundance of Wyra and Paler reservoirs was given in Table 3 and Fig. 3.

The Biodiversity index was given in Table 4. The anthropogenic and agricultural activities may have changed the diversity in the both reservoirs which is well reflected by the species composition in this area.

Equitability near zero shows the community to be dominated by one species. Equitability near 1.0 indicates an equal balance between all species (Laila, Vimal & Rozie, Undated).

From the above data values it can be interpreted that there is low diversity and an equal balance between all the observed species.

To monitor ecosystem health there is a need to specify more number of indicators than simple integrative diversity index, Rocco Labadesa clearly states that some healthy ecosystems can display low diversity indices (Alcolado, 2015)

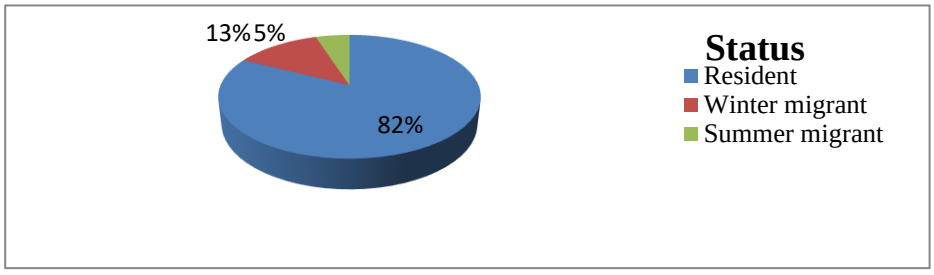

Figure 2 Species percentages of Status of Birds in Way, Paler reservoirs (Jan 2010-Dec2011)

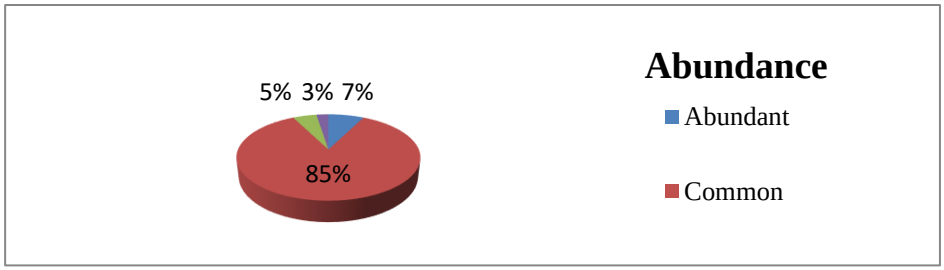

Figure 3 Species percentages of Abundance of Birds in Wyra, Paler reservoirs (Jan 2010-Dec2011)

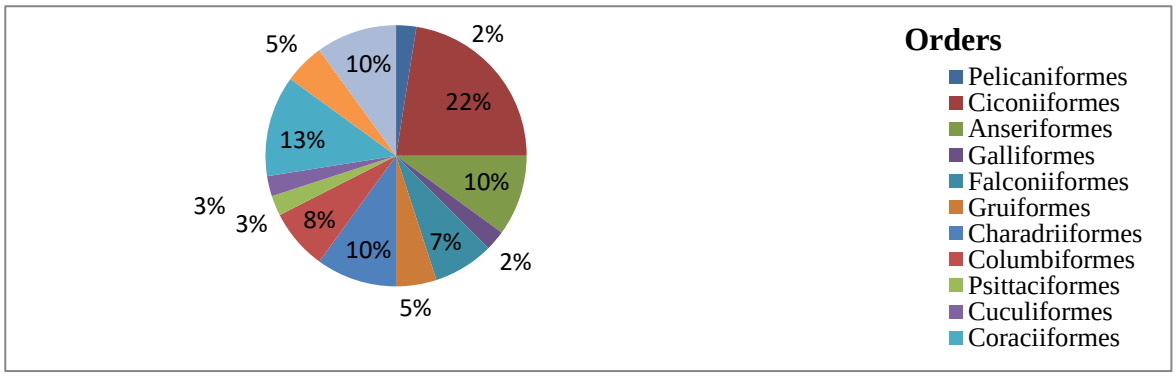

Figure 4 Order wise Avifauna abundance of Wyra, Paler Reservoirs (Jan 2010 - Dec 2011).

Table 3 Avifauna abundance of Wyra, Paler Reservoirs (Jan 2010-Dec 2011)

S.No.	Order	No of Species available
1.	Pelicaniformes	1
2.	Ciconiiformes	9
3.	Anseriformes	4
4.	Galliformes	1
5.	Falconiiformes	3
6.	Gruiformes	2
7.	Charadriiformes	4
8.	Columbiformes	3
9.	Psittaciformes	1
10.	Cuculiformes	1
11.	Coraciiformes	5
12.	Piciformes	2
13.	Passeriformes	4

Table 4 Biodiversity index of Avifauna in Wyra, Paler reservoirs (Jan2010-Dec 2011)

Order	BioDiversity Index
Pelicaniformes	0.0400
Ciconiiformes	0.1457
Anseriformes	0.1
Galliformes	0.0400
Falconiiformes	0.0843
Gruiformes	0.065
Charadriiformes	0.1
Columbiformes	0.0843
Psittaciformes	0.0400
Cuculiformes	0.0400
Coraciiformes	0.1128
Piciformes	0.065
Passeriformes	0.1

Table 5 Observed Data List of Avifauna Resources in Wyra, Paler Reservoirs (Jan 2010 - Dec 2010).

Order	Family	Genus	Species	Local Name	Status *	Abundance* *
Pelicaniformes	Anhingidae	*Anhinga*	*Anhinga melanogaster*	Darter	R	C
Ciconiiformes	**Ardeidae**	*Bubulcus*	*Bubulcus ibis*	Cattle Egret	R	C
		Ardea	*Ardea cinerea*	Grey Heron	R	C
			Ardea purpurea	**Purple Heron**	**WM**	**C**
		Ardeola	*Ardeola grayii*	Indian Pond Heron	R	C
	Ciconiidae	*Mycteria*	*Mycteria leucocephala*	Painted Stork	R	A
		Ciconia	***Ciconia episcopus***	**White-Necked Stork**	**WM**	**C**
	Ardeidae	***Anastomus***	***Anastomus oscitans***	**Open bill Stork**	**SM**	**C**
	Threskiornidae	***Plegadis***	***Plegadis falcinellus***	**Glossy Ibis**	**SM**	**A**
		Threskiornis	*Threskiornis melanocephalus*	Oriental White Ibis	R	A
Anseriformes	**Dendrocygnidae**	*Dendrocygna*	*Dendrocygna javanica*	Lesser Whistling duck	R	C
		Nettapus	*Nettapus coromandelianus*	Cotton Teal	R	C

		Sarkidiornis	***Sarkidiornis melanotos***	**Comb Duck**	**WM**	**C**
		Anas	***Anas penelope***	**Eurasian Wig eon**	**WM**	**C**
Galliformes	Phasianidae	*Pavo*	*Pavocristatus Linnaeus*	Indian peafowl	R	C
Falconiiformes	Accipitridae	*Elanus*	*Elanus caeruleus*	Black Shouldered Kite	R	C
			Halia sturindus	Brahminy Kite	R	C
			Accipiter badius	Shikra	R	O
Gruiformes	Rallidae	*Gallinula*	*Gallinula chloropus*	Common Moor hen	R	C
		Amaurornis	*Amaurornis phoenicurus*	White Breasted Water hen	R	C
Charadriiformes	**Charadriidae**	***Tringa***	***Tringa glareola***	**Wood Sand piper**	**WM**	**C**
		Vanellus	*Vanellus malabaricus*	Yellow-Watt led Lap wing	R	R
	Jacanidae	*Metopidius*	*Metopidius indicus*	Bronze-Winged Jacana	R	C
	Recurvirostrida e	*Himantopus*	*Himantopus himantopus*	Black -Winged Stilt	R	C
Columbiformes	Pteroclididae	*Streptopelia*	*Streptopelia decaocto*	Eurasian Collared -Dove	R	C
			Streptopelia senegalensis	Little Brown –Dove	R	C
			Streptopelia chinensis	Spotted –Dove	R	C
Psittaciformes	Psittacidae	*Psittacula*	*Psittacula krameri*	Rose -ringed Parakeet	R	C
Cuculiformes	Cuculidae	*Hierococcyx*	*Hierococcyx varius*	Brain fever bird	R	C
Coraciiformes	Alcedinide	*Alcedo*	*Alcedo atthis*	Small Blue King fisher	R	C
		Halcyon	*Halcyon smyrnensis*	White-Breasted King fisher	R	C
	Meropidae	*Merops*	*Merops orientalis*	Small Bee-Eater	R	C
	Coraciidae	*Coracias*	*Coracias benghalensis*	Indian Roller	R	C
	Upupidae	*Upupa*	*Upupa epops*	Common Hoopoe	R	C
Piciformes	Capitonidae	*Megalaima*	*Megalaima haemacephala*	Coppersmith Barbet	R	C
	Picidae	*Dinopium*	*Dinopium benghalense*	Lesser Golden-Backed woodpecker	R	R
Passeriformes	Motacillidae	*Motacilla*	*Motacilla maderaspatensis*	Large Pied Wagtail	R	C
	Estrildidae	*Lonchura*	*Lonchura punctulata*	Spotted mina	R	C
	Sturnidae	*Acridotheres*	*Acridotheres tristis*	Common Mina	R	C
	Corvidae	*Corvus*	*Corvus splendens*	House Crow	R	C

***Status:** R-Resident, WM- Winter migrant, SM- Summer migrant; ****Abundance**: A-Abundant, C- Common-Occasional, R-Rare scientific name with † symbol

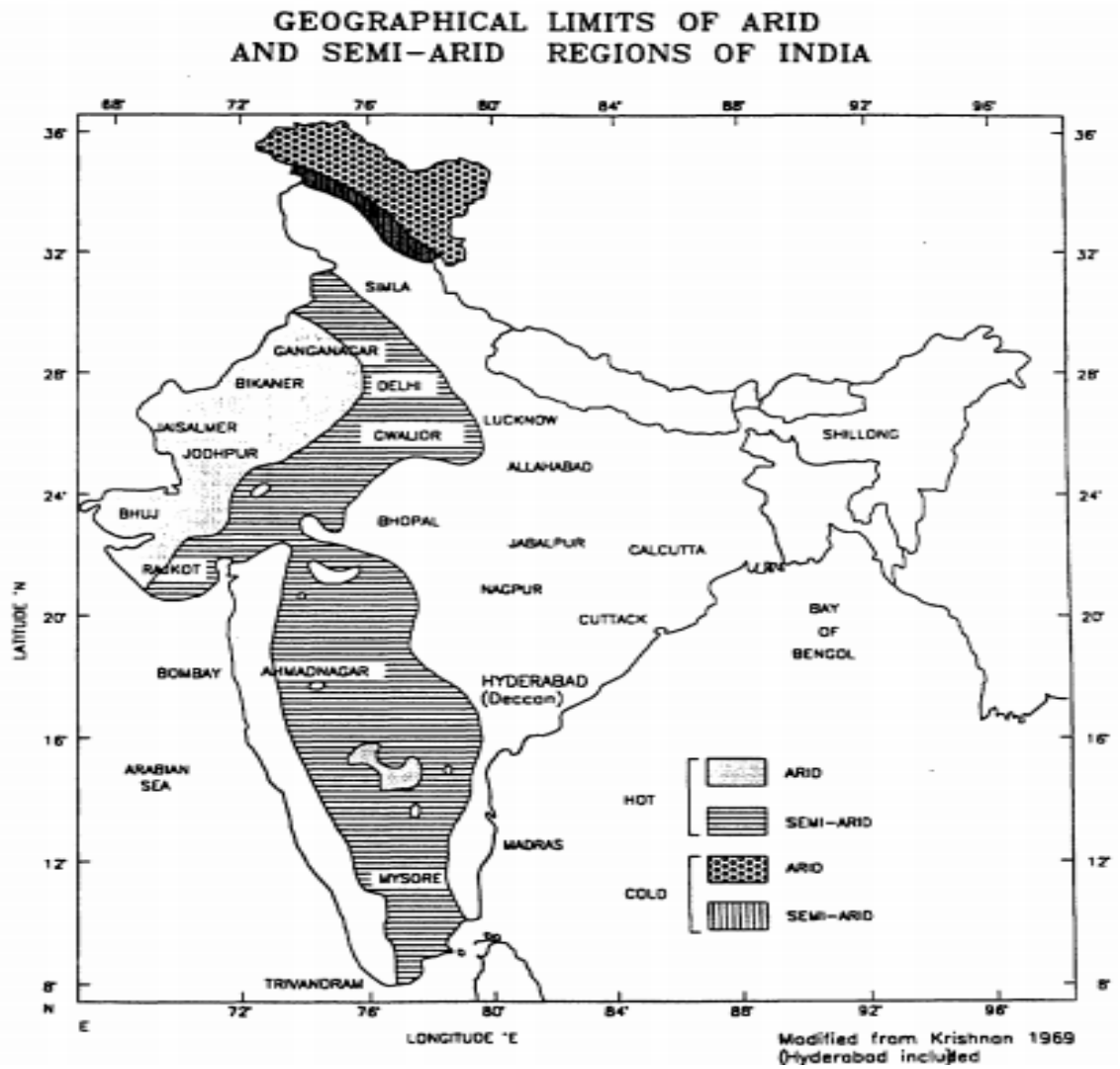

Figure 5 Arid and Semi-Arid Regions of India (Source: Balachander, 2010)

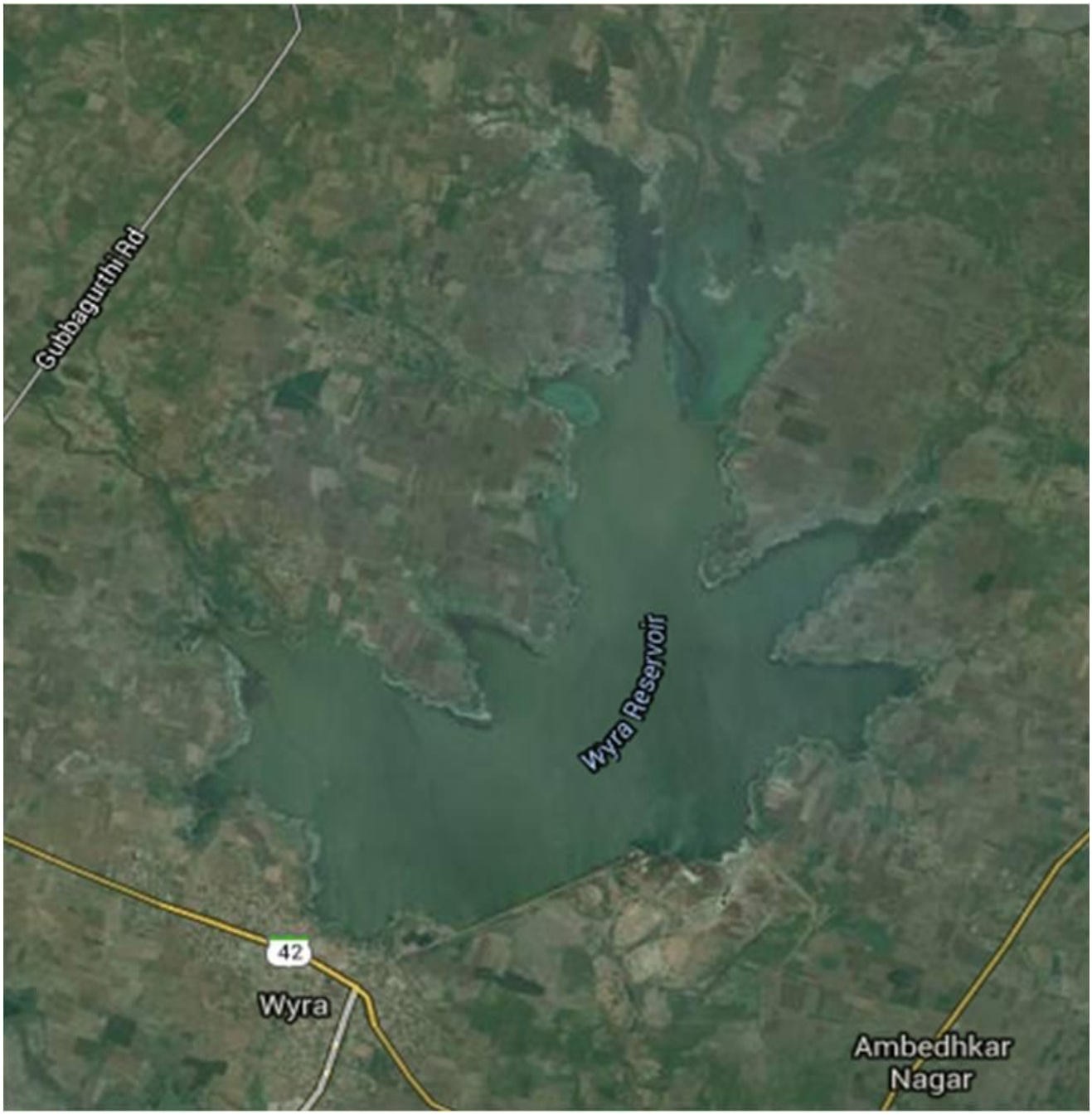

Figure 6 Wyra Reservoir, Khammam, Telangana, India (Source: Google Map)

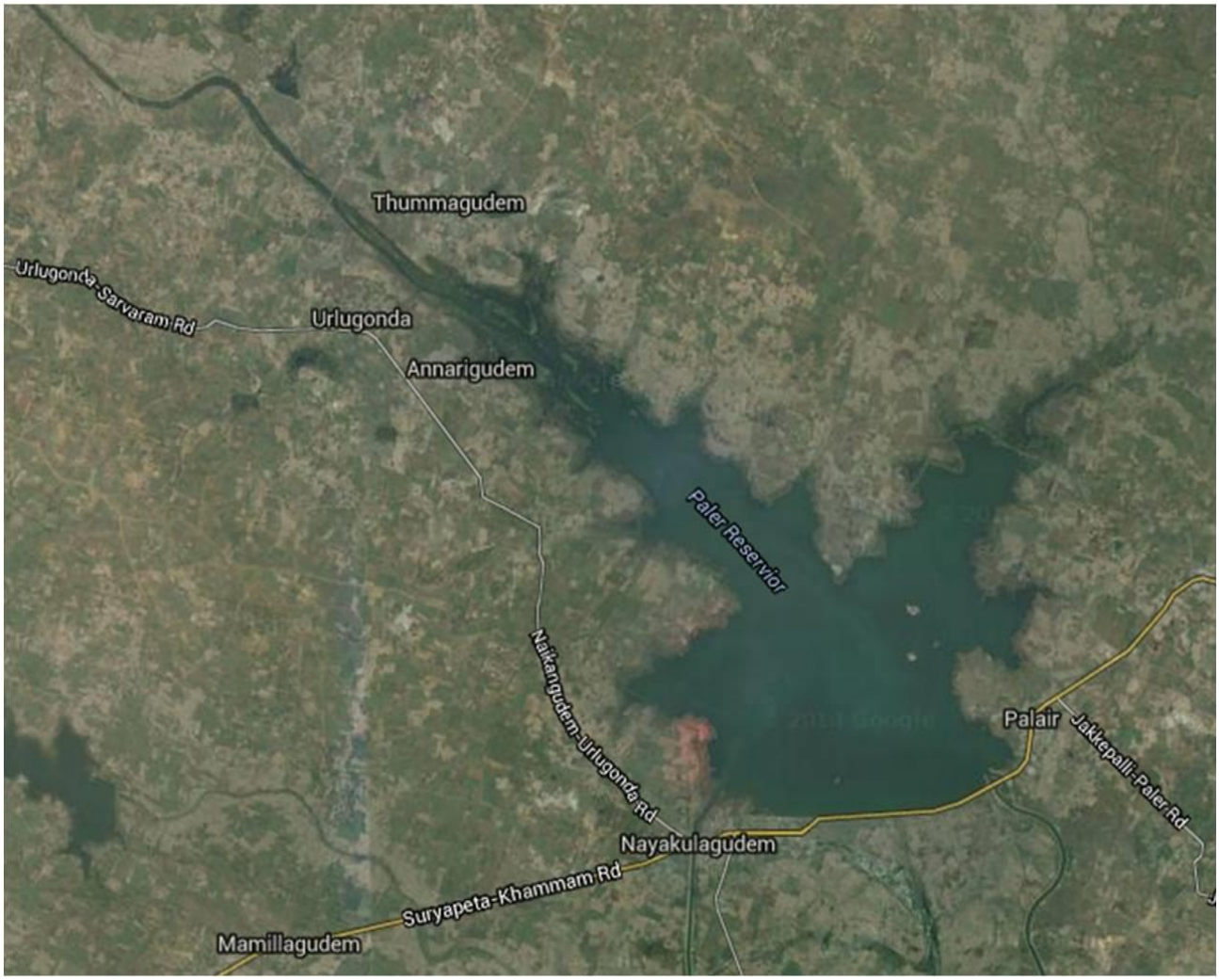

Figure 7 Paler Reservoir, Khammam, Telangana, Inida (Source: Google Map)

4. CONCLUSION

In the observed data, a total of 40 species of birds are found belonging to 13 orders. Among these, 82 percent species are available as Resident species, among these resident species about 10% are belonging to Passeriformes and 2% are belonging to Galliformes Orders are found in and around Wyra and Paleru Reservoirs of Khamma District, Telangana, India. It is in compliance with what was stated and appearing in the benchmarking data brought for the hot arid and semi-arid regions of India, as mentioned in the section 7 (b).

A resident bird stays through the seasonal time of shortage and scrounges for food that is available; or harvest food during the time of supply for the time of need. Birds that spend all year in one place and do not migrate are called Resident Birds (NPS-PRNS, 2002).

In addition to the above species, within the 13 order species, 22% of Ciconiiformes are predominantly found as major dominant order followed by other orders as shown in the Fig 3. 85% of species are most commonly available in around the reservoirs. There are 5 species of birds belonging to 5 genuses which in turn belonging to 4 families that further belonging to 3 orders observed as Winter Migrants. Similarly there are 2 species of birds for 2 geniuses' – 2 families that are belonging to 1 order observed as Summer Migrants.

For example, the reason for migration of Purple Herons could have adapted by habitat-switching and by changes in diet and nest site choice (van der Winden, Poot & Horssen, Undated). A bird that moves seasonally from one region to another, usually for breeding and feeding is called a migrant. The status and availability criteria towards suitability of environment and their sustainability are determined based on the factors such as habitat, food and breeding (NPS-PRNS, 2002).

Wyra and Paler reservoirs support large numbers of resident and migratory species of birds. Availability of food, vegetation, agricultural lands, and accessibility of water in the area, field activities and good climatic conditions were observed for favorable conditions for birds to survive in these areas. Long term assessment of bird species richness will help in understanding the impact of changing environment on avifauna and also support in creating a scientific database for proper management of the ecosystem to ensure better conservation at both the reservoirs and the avian diversity.

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